



# ***Enhanced Situational Awareness via SWIM-based applications***

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# Common Situational Awareness



- *To achieve the efficiency gains necessary to support the increasing demands on the NAS, common situational awareness is mandatory for all Airspace Users and ANSPs*
- *Common Situational Awareness is enabled by information sharing through System Wide Information Management (SWIM) initiatives*
- *New applications and decision support tools must take advantage of the timely, accurate information that is shared via SWIM to provide users with common situational awareness for optimum use of the airspace*
- *The resulting set of data, functional services, and end-user applications can provide necessary benefits with infrastructure cost reductions as the first step towards SWIM-enabled operations*

# Overview of LM R&D Activities



- ***To validate the information sharing concepts and demonstrate the benefits of enhanced common situational awareness, SWIM-based applications, services and infrastructure were prototyped***
- ***Two key operational threads in the NAS have been the focus of the LM SWIM test bed:***
  - *Flight data sharing using the URET/ERAM Flight Object*
  - *Special Activity Airspace (SAA) management (SAAs include SUAs, MOAs, etc.)*
- ***The LM SWIM test bed models real NAS operations using representative automation systems***
  - *Washington, DC (ZDC) Air Route Traffic Control Center (ARTCC)*
  - *Richmond Virginia Airport Tower*
  - *Delta Airlines Operations Center (AOC)*
  - *ATC System Command Center (ATCSCC)*
  - *Patuxant River Naval Air Station*
  - *Live, recorded scenarios from a day in the NAS*

# Flight Object Overview



- ***The Flight Object was deployed to the field as part of URET in 2001***
- ***Taking the next step, the Flight Object R&D prototype:***
  - *Is based on ICAO flight data and the URET Flight Object*
  - *Provides a platform and middleware independent open XML format*
  - *Is designed to facilitate adding new fields to support new applications*
- ***ERAM has extended the Flight Object content and added new capabilities***
  - *ERAM Flight Object forms the basis of the FAA-Eurocontrol Flight Object Harmonization effort for the US*
  - *ERAM Flight Object forms the basis of the next generation flight plan under development by the US FPLSG for ICAO standardization*

***The URET and ERAM Flight Object forms the foundation for  
O&M benefits to NAS Service Providers and Users***

# FDIO Overview

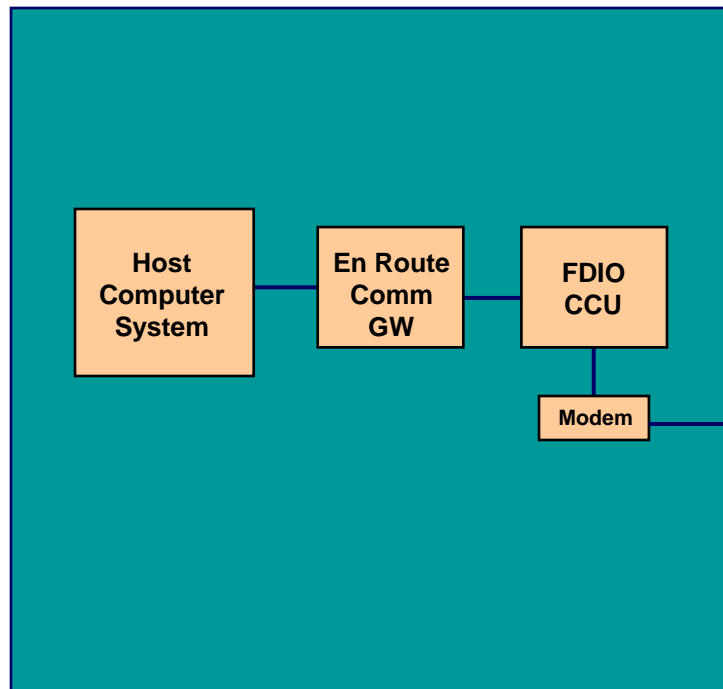


- ***The FDIO system is currently deployed in Terminal and Tower environments and provides entry and display of flight data from the Host Computer System***
- ***The current FDIO system uses '70s technology keyboard, display and flight strip printer to manage flight data and print strips***
  - *FDIO has sustainment issues and needs a technology refresh*
- ***There are a number of other En Route / Terminal systems that use the FDIO interface to access flight data (e.g., EFSTS, PDC/TDLS, DSP, San Juan D-position, etc.)***
  - *These systems all provide limited capabilities because their flight data access is restricted by the FDIO interface*
  - *There is a large infrastructure support cost required to maintain these because each was developed as a unique, stand-alone application*

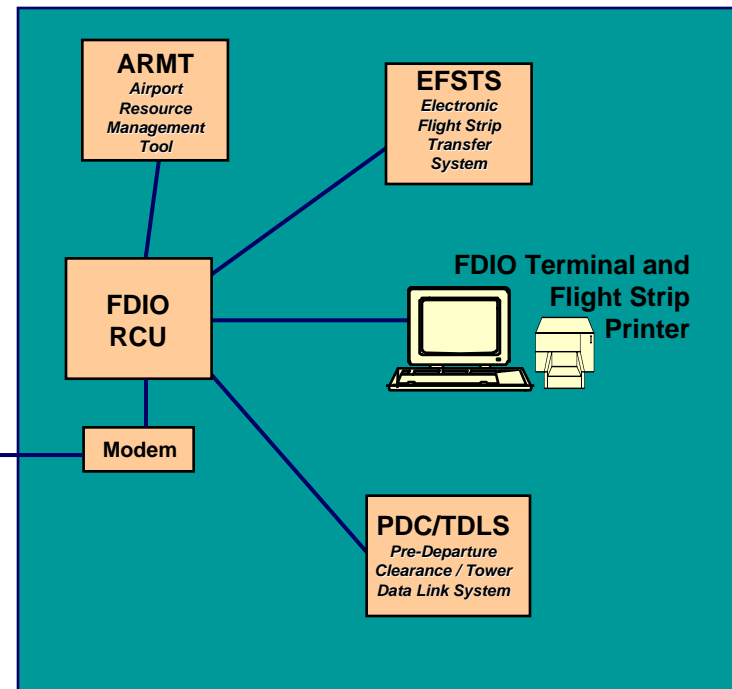
# Current FDIO Environment



## En Route - ARTCC



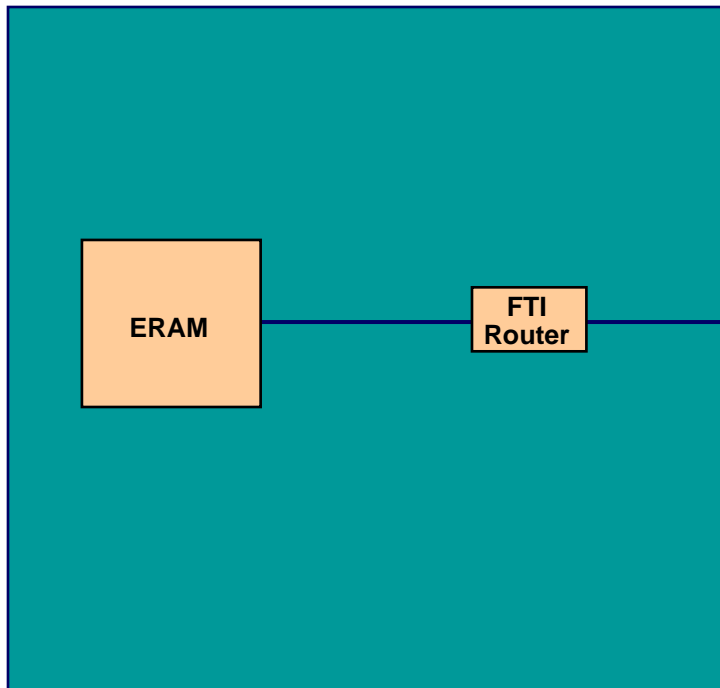
## Terminal / Tower



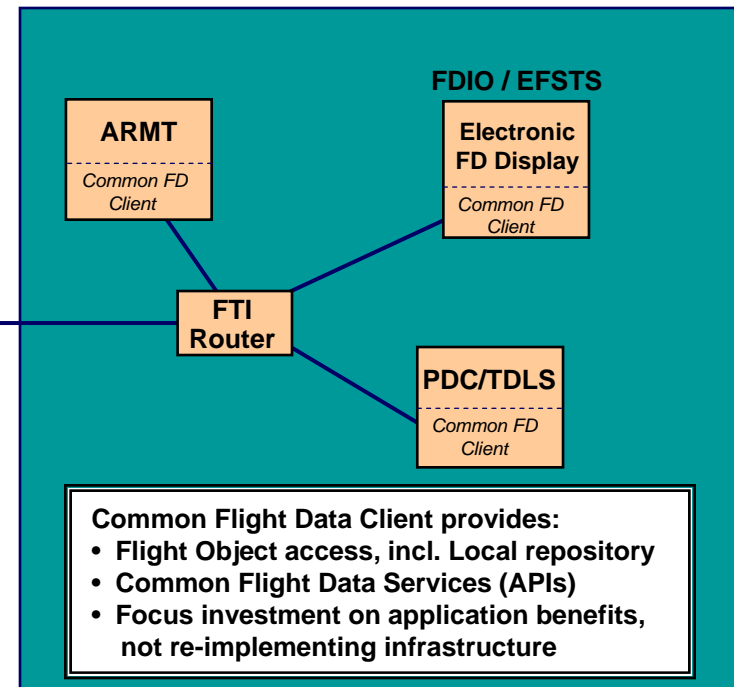
# SWIM Enabled FDIO Environment



## En Route - ARTCC



## Terminal / Tower



# FDIO R&D Prototype Overview

- **This LM R&D prototype provides the basis for a technology refresh solution for FDIO**

- *Java client, using Flight Object data published in a SWIM environment*
- *Prototype FDIO CHI based on the URET/ERAM Aircraft List display*
- *Pop-up templates provide improved data entry efficiency*

The screenshot displays the FDIO Richmond Tower application interface. It features several data tables for flight information and a pop-up window for amendments.

**Taxi Table:**

Flight ID	Type	Alt	Code	Time	Route
DAL1745	1/B738	360	0557	P1450	RIC.YEAST 1.LYH..JOINN.WOMAC2.ATL/0113
N402GS	1/BE40	90	P1630		RIC..COLIN..OTT.OTT6.BWI/0033
ASH2979	1/E145	280	6503	P1515	RIC.YEAST 1.LYH.MAJIC9.CLT/0043

**Proposed Table:**

Flight ID	Type	Alt	Code	Time	Route
PCE757	1/B752	380	6277	P1500	RIC..HPW.V213.MAZON.CVI.J193.WEAVR.J121.CH5.JJ79.OMN.BITH07.MCO/0133
HKJ58	1/C56X	280	1343	P1530	RIC.YEAST 1.LYH.MAJIC9.CLT/0048

**Departures Table:**

Flight ID	Type	Alt	Code	Time	Route
LOF3601	1/J541	70	5327	D1343	RIC./TAPPA208018..COLIN.V16.PXT.V93
COM892	1/CRJ1	220	7063	D1440	RIC.YEAST 1.MOL.J24.HVQ..HNN.JAVIT 1.CY
BT2761	1/E45X	210	2162	D1850	RIC./RIC085010..SWANN.DYLIN2.EWR
AWI337	1/CRJ2	320	7005	D1448	RIC.YEAST 1.MOL..GEFFS.J149.FWA.OXI3.OI
N28VY	1/BE20	100	0550	D1340	RIC..CARML..SBY..EOX/1434

**Arrivals Table:**

Flight ID	Type	Alt	Code	Time	Route
HTL393	1/BE40	270	2505	D1333	HOU./MOL264080..FAK..RIC
COM261	1/CRJ2	260	3336	D1344	LGA./3944N/7439W..VILLS..SBY.V1.CCV..
COM260	1/CRJ1	210	4026	D1350	CVG./HVQ.J24.FAK..RIC/1425
N122K	1/BE9L	190	7257	D1350	9A1./SPA210005..RIC*
LOF3616	1/J541	90	7476	D1402	PIT./GVE176013..FAK..RIC

**Overflights Table:**

Flight ID	Type	Alt	Code	Time	Route
DAL261	1/B732	370	7146	D1409	ATL./SPA.J14.RIC.OTT6.BWI/1452
TRS416	1/B712	350	3245	D1410	MCO./CH5.J79.TYI.J40.RIC.OTT6.BWI/150
NS05M	1/B350	90	3130	D1335	GSP./RIC247012..GARED.V16.ENO.V29.1
DAL1850	1/MD88	340	1477	D1428	BOS./EMI064012..MOL.WOMAC2.ATL/1547
N1039P	1/C182	60	7345	D1917	LEB./LVZ.Y29.SWL.V139.CCV.Y38.RIC.V157.LVL.V155.RDU..0A7

**Amendment Pop-up Window:**

ACID: COM775 Type: 1/CRJ1 Code: 7076  
 Speed: 463 Fix: RIC Time: P1432  
 Assigned Altitude: Requested Altitude: 280  
 Route: RIC..HPW.V213.MAZON.CVI.J193.WEAVR.J121.CH5.JJ79.OMN.G59H1.FLL/0156  
 Remarks:   
 Send Cancel

**Footer:** ZDC Wed Apr 19 11:17:21 EDT 2006 swim01@tlls FDIO 11:17 AM

# Flight Plan Pre-Processor Overview



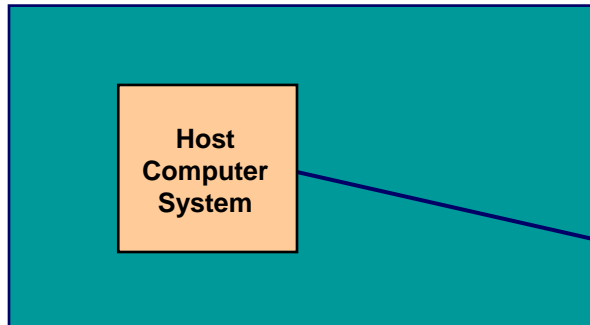
- **The Flight Plan Pre-Processor is a new capability for Airspace Users (e.g., Airlines, Business Jets, GA, Military) to optimize pre-flight (and in-flight) collaboration**
- **Provides Airspace Users with a flight plan trial capability that uses the operational FDP algorithms and airspace adaptation**
  - *Processes submitted flight plans exactly as the operational ATC system will and provides feedback to the Airspace Users*
    - *Identical airspace adaptation, restrictions, route status for ANSPs and Airspace Users = Common Situational Awareness*
- **Provide Airspace Users with a mechanism to express their intent earlier and more accurately**

**Benefits – Enhances the ability to file efficient routes, avoid restrictions, enhances economic performance of the Users and the efficiency of the NAS**

# Current AOC Flight Data Interface

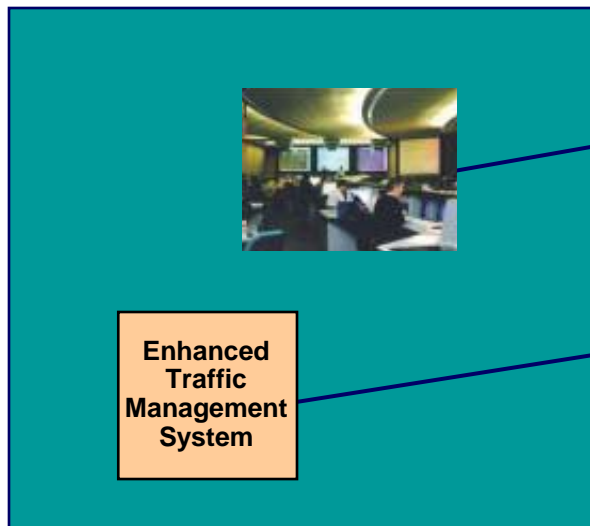
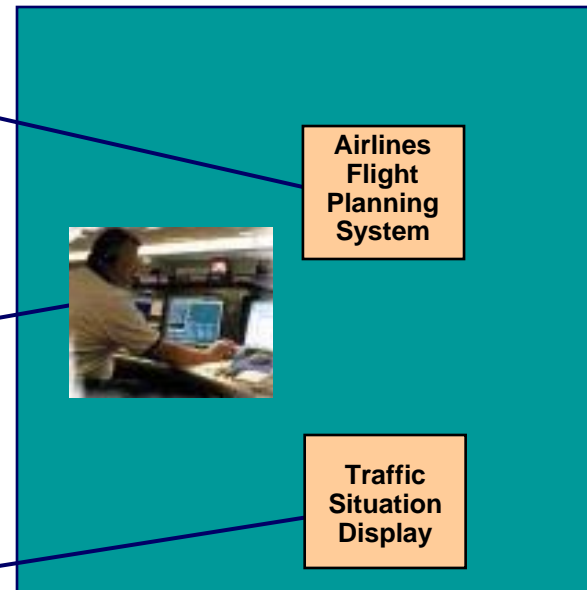


## En Route - ARTCC



Flight Filing  
Service-B

## Airline Operations Center



ADSI

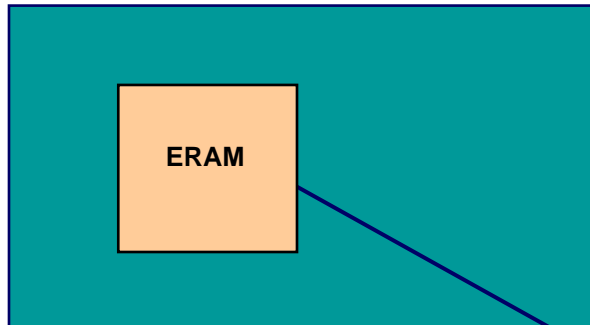
Phoneline

## Traffic Flow Management

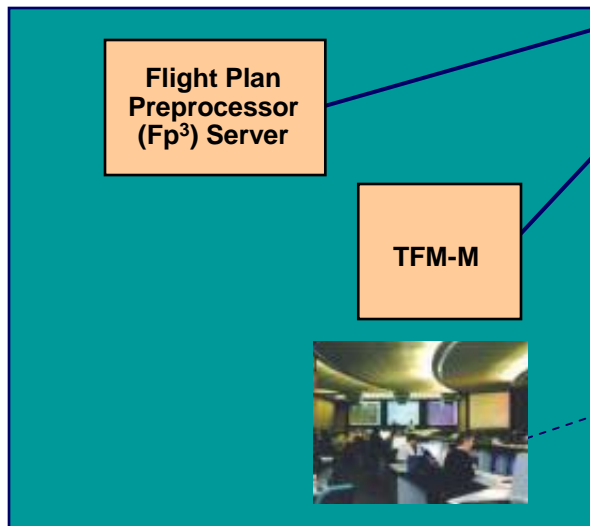
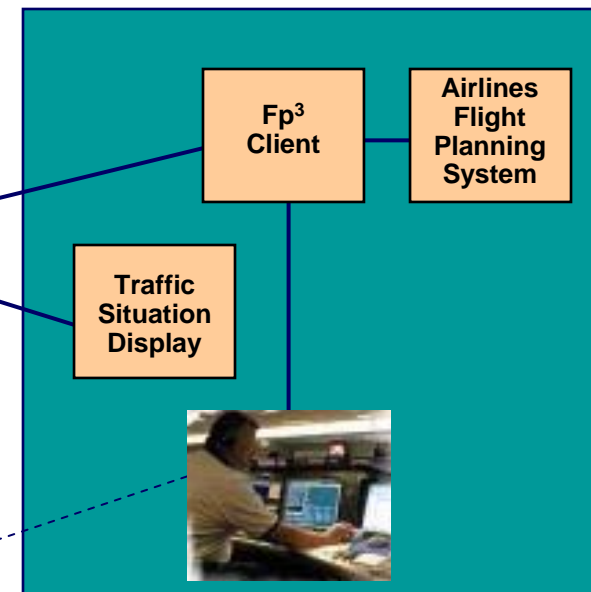
# SWIM Enabled AOC Flight Data Interface



## En Route - ARTCC



## Airline Operations Center



## Traffic Flow Management



Phoneline

# Fp<sup>3</sup> Sample Views – Main Screen



FPPP - Delta Airlines

### Delta Airlines Operations

#### Flight Plan Summary/Selection

Callsign	Status	Ver	Dept Time	Altitude	Speed	AC Type	Equip	Error	Restr	Pref Rt	SAA	Route / FP Text	Remarks
DAL101	Unsubmitted	1	L 11/04 14:00	380	420	B774	SWWS	-	-	-	-	RIC..SIE.J55.BOS/0130	
DAL1419	ACTIVE	SWM	A 11/04 14:28	340	441	MD88		-	-	-	-	BDL./EMI.J48.MOL.WOMAC2.ATL/1550	
DAL1850	ACTIVE	SWM	A 11/04 14:28	320	445	MD88		-	-	-	-	BOS./EMI.J48.MOL.WOMAC2.ATL/1547	
DAL1945	ACTIVE	SWM	A 11/04 14:01	220	444	B733		-	2	-	2	LGA./MXE.V378.BAL..DCA/1424	
DAL261	ACTIVE	SWM	A 11/04 14:09	370	419	B732		-	4	-	-	ATL./SPA.J14.RIC.OTT6.BWI/1452	
DAL301	Submitted	1	L 11/04 14:10	380	420	MD88	SWWS	No	7	1	1	RIC..ENO..LGA/0130	
DAL345	ACTIVE	SWM	A 11/04 13:54	370	437	MD88		-	5	-	1	ATL./RIC246071..OTT.DYLIN2.EWR	
DAL504	ACTIVE	SWM	A 11/04 13:31	270	455	B752		-	7	-	2	ATL./RIC232076..PXT.KORRY3.LGA	
DAL690	ACTIVE	SWM	A 11/04 14:21	310	443	MD88		-	4	-	2	ATL./SPA.J14.RIC.IRON84.DCA/1456	
DAL777	FILED	SWM	F 11/04 13:41	220	444	B733		-	-	-	3	LGA..DCA/1454	
DAL878	ACTIVE	SWM	A 11/04 14:23	320	445	MD88		-	-	-	-	PVD./EMI.J48.MOL.MACEY2.ATL/1547	

Add Flight Actions

Add New Flight

Selection Actions

Edit

Resubmit

File

Save trajectory

Delete

Testing Actions

Load FH file

Submit Dummy

Delete User Flights

Information Actions

Show Plan Details

Show Expanded Route

Show Trajectory

Show Restrictions

Show Pref Routes

Show SAAs

Show Feedback

Messages

10:43: recon add - COA239

10:43: recon add - SWA845

10:43: recon add - DAL878

10:43: recon add - COM259

10:43: recon add - DAL345

10:43: recon add - DAL777

Displaying 11 Records

Tue Mar 28 10:43:57 EST 2006

swim01@tilswm0: swim01@tilswm0: FPPP - Delta Airli

10:48 AM

# SAA Repository



- **SAA**s were chosen to demonstrate a basic type of aeronautical data in SWIM
- SAA status can be changed by ATC (URET) or via a Military Operator (SAA Web Page)

SAA Status - PAX - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://aps01:6001/swim/saa Search Print

Patuxent Naval Air Station

SWIM SAA Status Manager

SAA ID	Status	Source	Reason	Change
A220	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
A530-CY	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
APACHE	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
BIG APPLE	OFF	WEB	MANUAL	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
CANDY 2	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DEMO 1	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DEMO 2	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
A530	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
A531	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
ANTARES	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DEMO 3	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DINO EAST	ON	WEB	MANUAL	<input checked="" type="radio"/> ON <input type="radio"/> OFF <input type="radio"/> SCH
APPALACHI*	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
AR202	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
AW702	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DINO NORTH	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
AW703	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DINO S/A	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
BLUE RIDGE	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DINO S/B	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
CAPELLA	OFF	ZDC	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
DUKE	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH
CHESSIE A	SCHEDULE	ZDC	MANUAL	<input type="radio"/> ON <input type="radio"/> OFF <input checked="" type="radio"/> SCH
CHESSIE B	ON	WEB	MANUAL	<input checked="" type="radio"/> ON <input type="radio"/> OFF <input type="radio"/> SCH
FALCON 1	OFF	ZNY	DEFAULT	<input type="radio"/> ON <input checked="" type="radio"/> OFF <input type="radio"/> SCH

Submit Changes  
Turn Off All SAAs

SAA Status - P BEA AquaLogic swim01@tilaps swim01@tilaps swim01@tilaps swim01@tilaps Wed Apr 19, 9:26 AM

# Demand Calculator

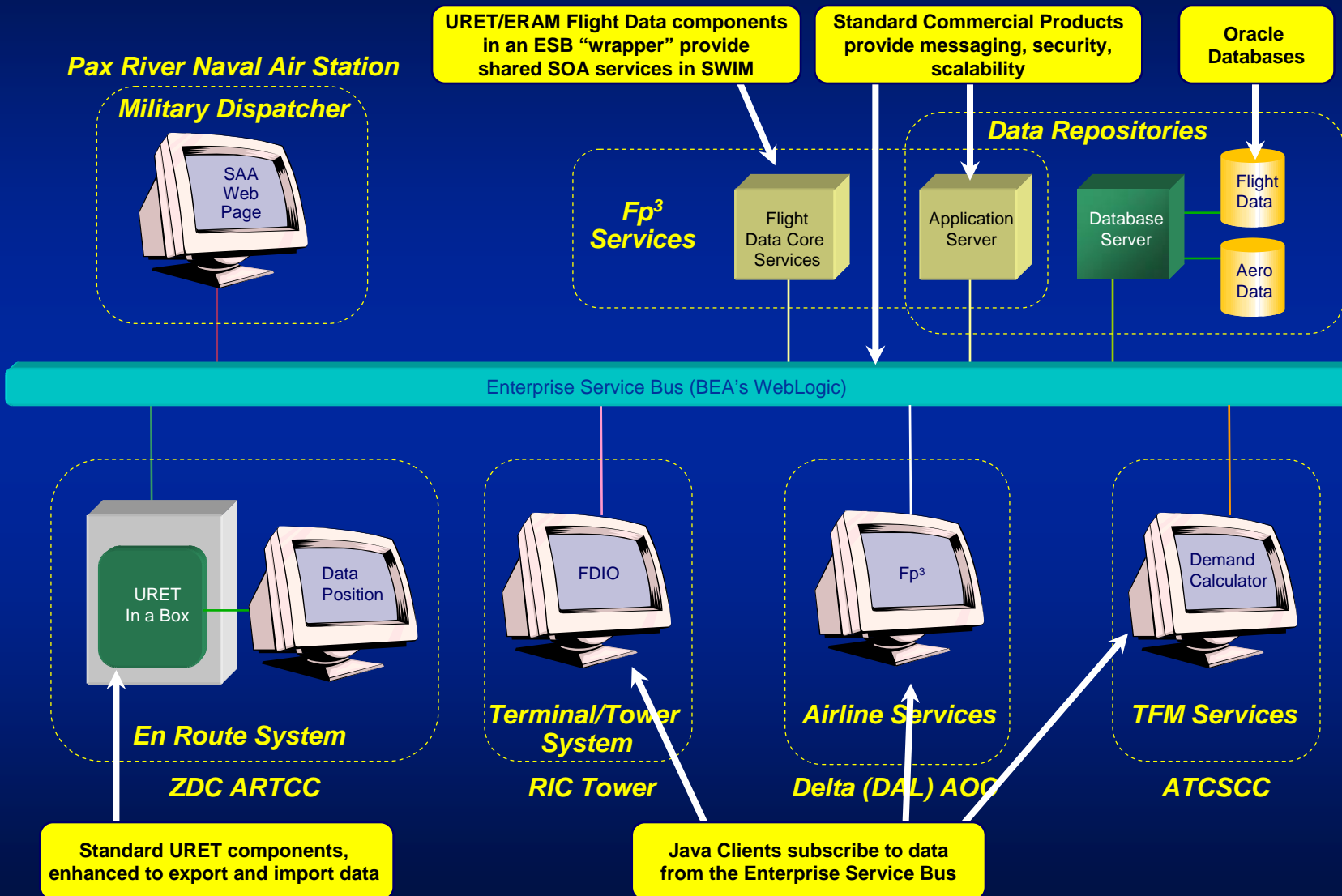
- **The Demand Calculator is an example of an application that can subscribe to SWIM data and provide value-add services to Users with very little development effort**
- **The Demand Calculator CHI is very similar to current TFM capability, but this Demand Calculator is far more accurate because it uses the A/C trajectory, which takes into account restrictions and ATC Preferred Routes**

Demand Calculator

Current system time: Fri Nov 04 13:49:05 EST 2005

Departures	Arrivals	Sectors	Flight List	Flights with Errors															
Name	* 13:45 *	14:00	14:15	14:30	14:45	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30			
ZCW 01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 02	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 04	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 09	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0			
ZCW 10	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 14	1	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 16	0	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 19	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0			
ZCW 20	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 21	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0			
ZCW 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 24	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0			
ZCW 29	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0			
ZCW 31	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 32	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 33	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0			
ZCW 34	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0			
ZCW 35	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0			
ZCW 36	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 38	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 50	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0			
ZCW 52	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0			
ZCW 53	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 54	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 60	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0			
ZCW 72	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ZCW 82	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0			
ZCW 86	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0			
ZCW 94	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0			
ZCW 96	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0			
ZCW 99	1	2	3	6	2	0	0	0	1	1	0	0	0	0	0	0			

# R&D Lab Physical Architecture



# Summary



- *Information sharing via SWIM can start now with existing systems that are in the field today*
- *SWIM-based applications, services and infrastructure provide the following benefits*
  - *Improved Common Situational Awareness*
  - *Reduced infrastructure costs*
  - *Improved efficiency of the NAS*